Technology Opportunity

MiPAC
MEMS Technologies for Microscale Particulate Classification

The MiPAC project concerns the development of MEMS technologies for the classification of particle size, shape, charge, and composition. The present effort is conducted jointly by NASA Glenn Research Center (GRC), The University of Minnesota, and the National Institute of Standards and Technology (NIST).

Potential Commercial Uses

- Particulate emissions
  –Vehicular
  –Aircraft
  –Industrial
- Environmental and health monitoring
- Clean room and surgical monitoring
- CVD process control
- Biological assessment
  –Airborne bacteria
  –Spores
  –Molds
- Bioterrorism
- Fire safety
- Liquid phase separation processes

Existing instruments predicated on optical scattering and/or electrical mobility classification are large and costly. The availability of compact, low-cost sensors affords the possibility for in situ monitoring and multipoint distributed sensors. Potential applications also include personal monitoring devices for assessing exposure to environmental hazards and biological agents.

Benefits

- Microscale sensors amenable to in situ applications
- Applicable to personal monitoring devices
- Small size and cost affords multipoint distributed sensor networks
- Device architecture suitable for deployment in harsh environments

The Technology

The measurement approach is based on tandem capabilities. Particles in the size range of 3 nm to 1 μm are characterized using electrical mobility classification (EMC). This method can also determine the natural charge state of the particulate distribution.

EMC is accomplished by subjecting incoming particles to free drift in an applied electric field. Individual particle mobilities are determined by exploiting the relationship between particle size and acquired charge in the presence of ionic collisions. Following classification by their respective mobilities, particles are counted either by optical methods or through measurement of their associated charge state. The realization of a microscale EMC device principally involves the fabrication of a suitable field drift channel and detector.

Particles in the range of 0.3 to 10 μm are classified by optical scattering. Such measurements also provide information about the shape and composition (refractive index) of both individual particles and particulate distributions. These characteristics are desirable in the characterization of aggregate soot structures and atmospheric particulates, as well as for the classification of certain biological materials. The fabrication of microscale optical devices is accomplished through the melding of traditional MEMS techniques with those of digital and micro-optical element fabrication.

The MiPAC project is presently funded under the Glennan Microsystems Initiative (GMI). The initial period of performance addressed the design and fabrication of EMC devices. Several units have been assembled and are presently being tested. The continuation of these efforts and the fabrication of micro-optical sensors is currently being proposed for continued GMI sponsorship.

Options for Commercialization

The MiPAC project presently involves the joint participation of NASA GRC, The University of Minnesota, and NIST. Two patents are presently being sought in the area of EMC, with intellectual property rights nominally assigned to NASA. Potential partnership agreements pertaining to any of the aforementioned application areas will be considered.

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